AD A052565

AU NO.

DDC FILE COPY

16 3E161102BS08

14 USARIEM-M-15/78

HUMAN PERFORMANCE UNDER CLIMATIC STRESS AND THE FALLACY OF THE "AVERAGE" SOLDIER: POTENTIALLY SERIOUS IMPLICATIONS FOR MILITARY OPERATIONS IN EXTREME CLIMATES[1] (U)

10 BERNARD J. FINE, [redacted] JOHN L. KOBRICK, [redacted]
U.S. ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE
NATICK, MASSACHUSETTS 01760

11 15 Mar 78 12 11 p.

Investigators in the life sciences in this country typically rely on normative concepts in evaluating the outcomes of experiments; that is, averages and/or variances are compared by means of statistical methods based on data for groups, and conclusions are drawn based on the probability of occurrence of the results obtained. The conclusions taken from research so produced usually are not tempered in any way as to their specific applicability to individuals within the group and, consequently, through a process of oversimplification, come to be interpreted as being applicable to people in general, or to the average person.

The concept of the average person is particularly embedded in the military milieu. It is implicit in the "can do" concept, based on the assumption that all soldiers can perform all tasks equally well under all conditions, and pervades most military actions, policies, and decisions. The military research establishment reinforces and perpetuates these policies by generating in-house or selecting from the scientific literature, research information which is a product of normative thinking. Almost all experimentally-derived human performance information included in military manuals and bulletins is based on normative concepts of average performance; although purportedly written for the individual soldier, they really refer to the average soldier. This is extremely important to recognize, since, otherwise,

[1]Human research reported herein as accomplished at the U.S. Army Research Institute of Environmental Medicine was reviewed and approved, in protocol form, by the Office of The Surgeon General for The Department of The Army in accordance with Army Regulation 70-25.

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

DDC
RECEIVED
APR 11 1978
B

040 850

JCP

the tendency is to form a false favorable impression of the extent to which the sciences can predict, understand, or explain behavioral phenomena of practical importance to the Army.

With reference to knowledge about the effects of climatic stress on human performance, the area of expertise within which this paper is written, thirty years of normative research have left even the simplest questions about individual human capabilities unanswered. At this time, one can do no better than to say that exposure to routinely occurring extremes of heat, cold, or altitude may adversely affect some people's performance of some tasks some of the time. One cannot specifically predict which people or what kinds of tasks will be affected, or when the effects, if any, will occur, let alone state the reasons for their occurrence.

The belief in and reliance on the concept of normative behavior by the military to account for troop performance and to anticipate future outcomes can be dangerously misleading. In fact, it can legitimately be termed the fallacy of the "average" soldier. This fallacy is founded on a gross misconception of the extent to which soldiers differ in all aspects of human functioning. The practical importance of these differences has been seriously underestimated by the military and this has led to untold numbers of military casualties, performance inefficiencies, accidents, and man-machine mismatches. The fallacy is even less appropriate, and much more serious, when applied to new concepts of a future army of individually trained specialists.

The normative approach to research and its opposite, the individual differences approach, do not differ substantially in basic experimental orientation. However, they do diverage significantly in research emphasis, as well as in assumptions made about human behavior.

In the normative approach, similarities among people are assumed- in fact, emphasized - regarding the structure and function of mind and body. In substance, this approach assumes that "a body is a body is a body," and, therefore, that "on the average," men are interchangeable. Such ideas are probably generic to our society with its dependence on mass-production, making possible the interchangeability of parts. If machines, why not machine operators? While obvious interindividual differences such as age, sex, and weight are recognized and often taken into consideration in the design and analysis of normative experiments, the implicit assumption typically is made that the basic underlying processes which "govern" behavior, and, thus, the behavior itself, must be the same from person to person. The experiment now becomes a device to determine that performance which, once known, is assumed to be standard under the given circumstances for all individuals. Differences between individuals are assumed to average out, if one takes a random sample of subjects for study. In statistical analysis, the variance due to subjects is considered to be

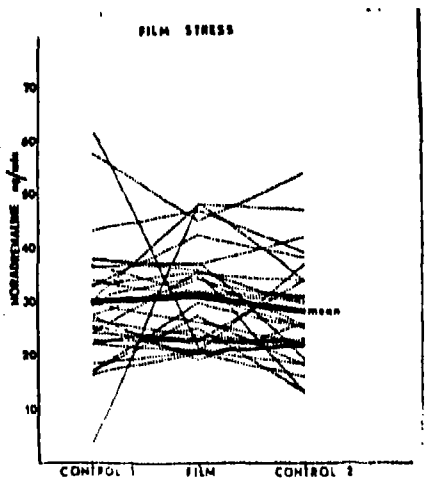
White Section
Buff Section
BY
DISTRIBUTION/AVAILABILITY CODES
Dist. AVAIL. and/or SPECIAL
A

unaccountable random error or "noise" in the system, which is basically irrelevant and antagonistic to the "science" of the research; i.e., it corrupts the picture of the "true" behavior. Again, random sampling is supposed to cancel the "noise."

On the other hand, the individual differences approach assumes that while people in general are grossly similar, they may differ quantitatively and qualitatively from one another in many ways. For example, some may be left-hemisphere dominant and some right-hemisphere dominant in brain activity. Some may respond to stress with increased and others with decreased excretion of the same hormone. Some may have more sensitive or stronger nervous systems than others. It is assumed that these kinds of differences can be categorized; in other words, that people can be classified into "types" on the basis of these and most other characteristics. Experiments are designed so as to maximize the possibilities of studying the differences between people and an awareness of the characteristics or "types" of test subjects is critical.

The issue is crystallized by questions such as: What kinds of information are obtained by the normative approach? Who is the "average" soldier? What is the meaning of an "average" response? The following examples bear on these questions. The first example, although taken from biochemistry, nevertheless relates to the behavioral area on which this paper is focused, and, thus, demonstrates that the principles being discussed here are general ones. Example 1 (1) shows the group mean (solid line) along with the individual excretion levels of the hormone noradrenaline (NA) of 25 soldiers measured before, immediately after, and several hours after viewing a two-hour film program depicting cruelty, violence, and torture.

Based on the group mean curve shown in Example 1, a reasonable normatively-oriented conclusion would be that the film had little effect on NA excretion. However, from the individual curves in Example 1, it is clear that: (1) approximately one-half of the subjects showed increases in NA excretion due to exposure to the film, while the other half showed decreases; (2) both initial- and post-control levels show large inter-individual differences under so-called "baseline" or non-stress conditions; and, (3) the initial levels show no relationship to

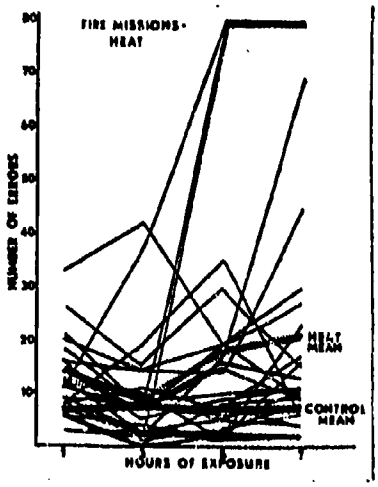


Example 1

the direction of influence of the film; that is, some subjects with initially high levels of NA nevertheless increased in NA excretion following exposure to the film, while some subjects with quite low initial levels decreased in NA excretion following film viewing.

An individual differences-oriented investigator would hesitate to conclude that there was no effect of the film, for only a few subjects actually showed no change. What, then, is the meaning of an "average" response in this situation? How many of the individual curves shown in Example 1 actually are of the same shape and magnitude as the derived "average" curve? Has the question of the effect of the film on NA excretion really been answered by the "average" curve presented in Example 1?

Turning to military performance, Example 2 shows the performance curves of 28 soldiers who participated in a heat stress study (2) at the U. S. Army Research Institute of Environmental Medicine (USARIEM). The task involved was analagous to one performed by artillery fire direction center personnal engaged in fire missions. The heavy solid line represents the average performance of the men over a period of seven hours under normal conditions (70°F, 50% RH). The heavy broken line represents the performance of the same men under severe heat stress (95°F, 88% RH). The difference between the two curves was shown to be highly significant on the basis of parametric statistics. Example 2 also depicts the individual performance curves (narrow lines) from which the averages were derived. Although only the individual curves for the heat stress are shown, it should be noted that considerable inter-individual variation in performance also occurred under normal conditions.



Example 2

Comparison of the group mean heat curve with the individual curves from which it was derived shows that the group mean curve fails to represent adequately the true behavior of the group. It is obvious that the very significant heat effect obtained was due to the reactions of only about 1/4 to 1/3 of the participants. The rest were either affected slightly or not at all.

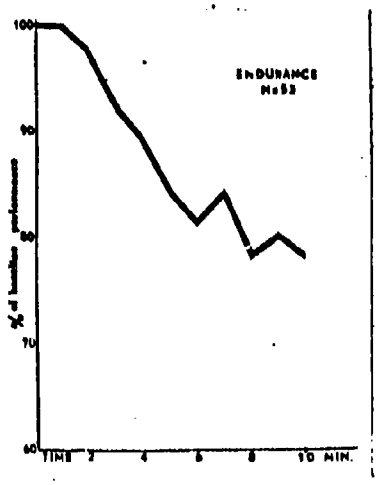
In the face of such discrepancies, one can legitimately

question the real value of average-curve performance data for serving the practical needs of the military field commander. Can he get from them a true estimate of what the effect of heat will be on the performance of his troops? When shown this kind of information, a commander typically will evince considerable interest, but then will ask: "Can you tell me ahead of time which men will be combat-effective, and which will fail?" This kind of question simply cannot be answered by use of a normative approach alone.

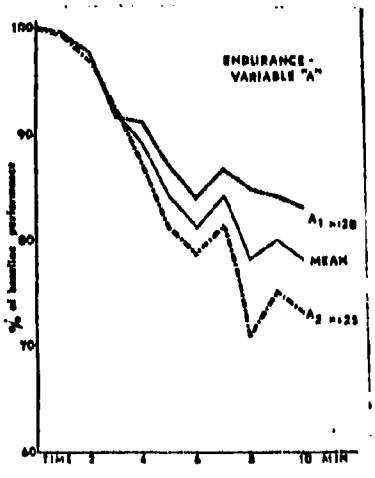
With questions like this, the commander is implicitly seeking information such as that shown in Examples 3,4,5, and 6. These examples are derived from actual (unpublished) data obtained in a research study at USARIEM.

Example 3 shows minute-by-minute group mean performance of 53 soldiers on an extremely trying test of physical endurance, that of attempting to squeeze a hand dynamometer for 10 minutes at a target level of tension previously determined to be virtually impossible. The data are expressed as percent of the target level achieved.

Example 4 illustrates the same performance, except that the data have been plotted for two sub-groups of the 53 subjects, separated on the basis of scores on a personality variable, referred to here as Variable A for illustrative purposes. Group A_1 are those subjects scoring above the median, and Group A_2 those scoring below the median of the "A" distribution. One can observe a large difference in performance between the curves of Groups A_1 and A_2.



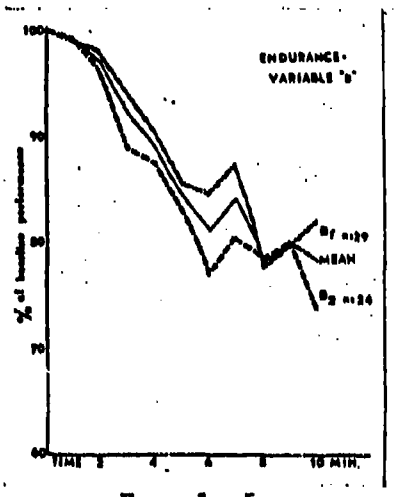
Example 3



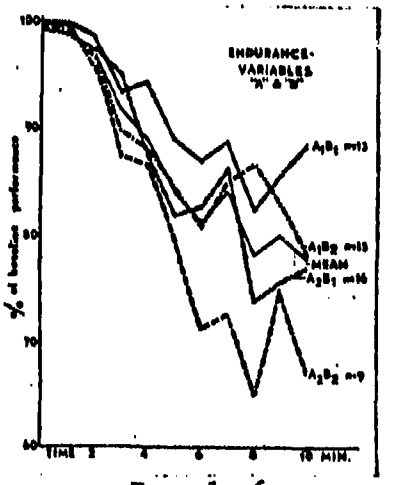
Example 4

In Example 5, the same index of performance is plotted for a second variable, "B". Sub-group B_1 involves those scoring above the median of the distribution of this personality variable, and sub-group B_2 includes those scoring below the median. Again, differences between the two groups can be seen, although not as large as in the case of Variable A.

Logically, it would be expected that subjects scoring above the median on both variable A and variable B would be the best performers, and those scoring below the median on both A and B would be the poorest performers. The data shown in Example 6 indicate that this actually was the case. The large differences in performance between groups A_1B_1 and A_2B_2 show that the original average-curve in Example 3 has little meaning.



Example 5



Example 6

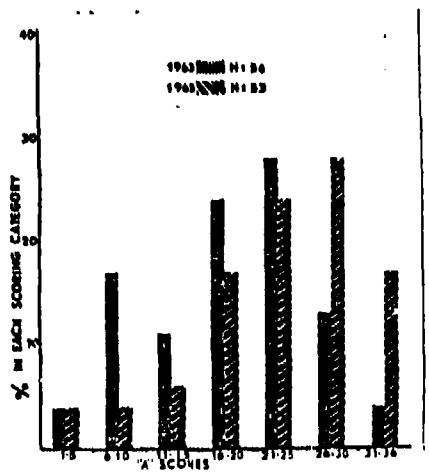
One should not conclude from the above discussion that all individuals perform consistently with a variety of tasks or stressors. The converse is more likely to be true. Individuals who excel on a task in the cold may be poor performers on the same task in the heat or at high altitude. Those who excel at high altitude may be poor performers in the heat, and so on. The problem of sorting out which kinds of individuals can best perform specific kinds of tasks in various climates will probably be best resolved by an application of the individual differences approach.

It has been noted previously that individual differences are assumed to average out in the normative approach, particularly when the group being studied is a random sample drawn from a large

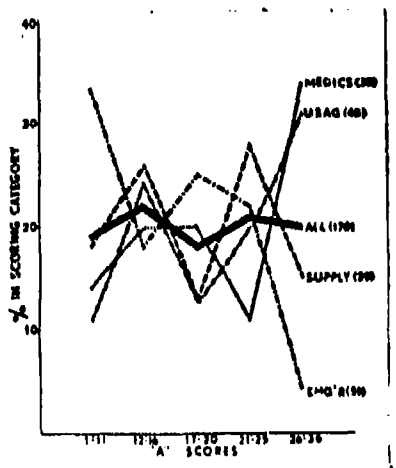
population. While this may be true in theory, such differences rarely average out in actual practice, particularly in the usual study which typically employs small numbers of subjects.

The risks inherent in this assumption are illustrated in Example 7 which shows the distribution of Variable A in two samples of nearly identical size, both drawn from Fort Devens, Massachusetts, one in 1963 and one in 1965. It is obvious that the two samples differ substantially. Given the relationship between Variable A and performance shown in Example 4, two quite different "average" curves would be obtained, depending upon which of the two samples, 1963, or 1965, was used in the study.

Example 8 shows yet another source of error which users of the normative approach are usually unaware of, or assume will average out. The average scores of 170 soldiers tested on Variable A at Fort Devens in 1972 are shown by the heavy solid line. It can be seen that the scores are evenly distributed throughout five scoring categories. However, when the subjects were divided according to the units from which they came, dramatic differences became apparent between units in the distribution of Variable A scores. Therefore, a sample of subjects selected from the Engineers unit will be very different from a sample selected from the Medical unit with respect to Variable A. If one is studying physical endurance, as depicted in Example 3, and the subjects are primarily from Engineer units, a very different average performance curve will be obtained than if the subjects were from Medical units.



Example 7



Example 8

All of these points would be academic except for one major consideration. Variables A and B above are actually psychological "individual difference" variables which have been shown to be related to many militarily relevant types of performance, such as; motor performance (3,4); vigilance (5,6); detecting booby traps in jungle terrain (7); identifying targets in aerial photographs (8); identifying targets in the field (9); motor vehicle accidents (10); monitoring visual information (11); and illness at altitude (12).

Failure to take into account these research findings has very likely resulted in many military personnel being exposed to avoidable hazards. For example, no military commander would send a soldier with very poor eyesight on a difficult reconnaisance mission. Yet some line troops with perfect visual acuity have been found to have considerable difficulty in detecting hidden or camouflaged targets (9). Undoubtedly such personnel are sent on patrol and other types of combat missions. Exposing those individuals to combat situations not only puts them at greater than usual risk, but also endangers other personnel who may be dependent upon them for critical perceptions.

While the studies cited above relate to military performance and are of the individual differences type, very few of them stem from programmatic research. Rather, they reflect the efforts of a relatively small number of investigators, the majority of whom are not allied with the military research establishment. In view of the issues raised above, what the Army appears to need is a strongly supported research effort incorporating the individual differences concept, and directed toward specific goals. Within the area of climatic-oriented research, the need for such an effort can be demonstrated particularly well by looking at cold weather military operations in Alaska, and by contrasting our situation and outlook in this regard with those of the Soviet Union (13).

Years ago, experience gained in previous military operations; e.g., World War II Europe, and Korea, was used to justify the need for more research on the effects of cold exposure on man. However, three significant aspects of current affairs now make the need for such research even more important:

1. The strategic value of the Alaska pipeline, in view of the world oil situation, and the need for its direct policing and security. The vulnerability of the pipeline was graphically demonstrated by the ease with which it was sabotaged on 15 February 1978.

2. Reports of Russian capability for military operations at Division strength in the Arctic for extended periods of time.

3. The unanimous opinions of Arctic military experts that the U.S. Army cannot presently conduct extended military operations in extreme cold.

A broader perspective on the comparative capabilities of the

U.S. and the Soviet Union for cold weather operations can be gained by considering the fact that the Soviet Union has had millions of people living under severe Arctic and sub-Arctic conditions for a substantial period of their history. For example, Murmansk, a city of over 500,000 population, is above the Arctic circle.

On the other hand, Alaska is only sparsely populated. Other areas of the United States which experience extremely cold weather also are not highly populated and, furthermore, lack the added stresses of the polar night and its attendant adjustment difficulties.

Consider not only the size differential between the cold-dwelling populations of the two countries, but also the length of time of residence of the inhabitants. Except for natives, trappers, and a few other hardy individuals, most cold-dwelling Americans are relative newcomers to such a climate, particularly when compared to the Russian people who have lived in the extreme cold for centuries. One might even expect the latter to have undergone some natural selection processes resulting in better cold survival. Reasoning from this, one must expect Russian cold-weather troops to be drawn from among these cold-dwelling peoples.

The comparative standards of living of the two countries should also be considered. The Russian standard is substantially lower than ours, and, as a result, the people are accustomed to expect extreme hardship in their daily lives. From this, they undoubtedly have acquired many simple and effective skills for coping with the environment, and for making the most out of their relationships with it. Coming from such a background, transition to the rigors of Arctic life, for the Russian, apart from family separation, would probably be relatively easy.

On the other hand, the American soldier assigned to the Arctic is transplanted abruptly from a temperate or even hot climate, leaving not only family but also comparative luxury and thermal comfort. There he is immediately subjected to many stressors not previously experienced. Despite all, he is expected to be highly motivated and productive.

These assignment practices stem directly from U. S. Army policy and doctrine which dictates that with leadership, training and support, the American soldier can function in any climate. But how effectively can he function? Can all men make this extreme transition?

The extremity of the transition is seriously underestimated. Individuals, most of whom dislike the extreme cold and some of whom already have psychological problems, are put into the field in small groups, usually isolated, under conditions of prolonged semi-darkness. They have little or no experience with the Arctic and only rudimentary survival training. They must contend with vehicles, weapons and communications systems which often become inoperable in Arctic cold. Furthermore, they feel no real purpose for being where they are.

Temperatures range from -30°F to -80°F combined with wind, a completely unforgiving environment where human flesh can freeze in less than one minute and where one mistake, theirs or someone else's, can mean loss of limbs or death. It should hardly be surprising to find that under these conditions some individuals literally cease to function, or begin to behave in bizarre ways.

To properly understand the problem, one must distinguish between the concrete and the abstract aspects of cold. Concrete aspects refer to effects of being cold on the individual's organic and behavioral functions, such as core and skin temperature, speed of chemical reactions and neural transmission, metabolism, psychomotor and mental performance. Most research, both laboratory and field, has focused on concrete aspects almost exclusively.

However, the abstract aspect of cold may be even more critical but has not been examined systematically. By abstract aspect of cold is meant that extreme cold, in the range of -40°F and below, represents a threat to a man's life which at the very least rivals the hazards of combat. The evidence, most of which is anecdotal rather than scientific, points to the fact that the effects of extreme cold resemble those of combat in that cognitive and motor aspects of the brain appear to become dissociated in some individuals.

Consider the following anecdote: A squad on an exercise is caught in a sudden temperature drop, down to -80°F. A man who thinks his feet are freezing tells the leader to stop. When the group halts to make camp, the leader orders the man with cold feet to gather wood and start a fire. The man simply stares back at him, apparently uncomprehending, hugging himself. After several further attempts to get the man moving, the leader gets the wood himself and starts a fire. When questioned later, the man indicated that he had heard the leader, understood everything that was said, realized that he would have been better off if he had followed orders and kept active, but was unable to move.

Other anecdotes differ in situation, but are similar in substance. Men have burned their survival gear to keep warm instead of leaving the fire to get wood which was readily available nearby; men, including commanders, have become virtually inert at temperatures of -80°F and have failed to perform chores necessary for their own survival, such as unloading nearby trucks laden with food and fuel supplies; and men who normally function well in the cold have started to have psychological problems when told to remove a mitten to work on a piece of equipment.

Rioch (14) has addressed this general problem, speaking of the "body failing to support the brain," and cites S.L.A. Marshall's Omaha Beach story:"....We had more beaten troops there than we had troops that were successful. It was only a small fraction of Americans that pulled us out of a great disaster. We had companies that

folded completely. Men who were obviously physically strong drowned because they did not have the strength to pull themselves out of the water which was only two or three feet deep. I'm convinced that we lost more men from drowning than we did from enemy fire." Rioch states: "Whether or not this was due to the sudden exposure to extreme danger following a long passage in a landing craft is a matter of speculation. It may be noted, however, that equivalent factors would be involved in flying paratroopers from distant fields into the Arctic for a dangerous jump."

Thus, danger seems to produce a separation of cognition from motor behavior in some men, while others can successfully withstand such stress. How do we identify these latter types of men? Could we use them as the nucleus of special stress-resistant troops for duty in the Arctic and other strategic areas of importance?

Must the disasters of Korea be repeated? Consider an incident in the Korean War, at a temperature of -18°F, as related by S.L.A. Marshall: "They decided to move on. Halfway up the next ridge the column stopped. Davis moved up front to see what had happened. Nothing had happened, except that they could not move anymore, at least they thought they couldn't. So Davis took the lead...and...they got to the top of this ridge and then, by the witness of Davis and his fellow officers, they saw happen what they never expected to see happen among Marines. As each company came over that ridge, the men fell flat on their faces in the snow and not a man would move...."

There is very little research relating directly to this kind of behavior under stress. The normative approach does not properly conceptualize this kind of problem, but, rather, seeks universal principles applicable to all men; unfortunately, there are very few such principles. A more individual-specific approach is needed, one which emphasizes individual differences.

In contrast, the Russians are strongly emphasizing the individual in their research. For example, a publication (15) about bioelectric activity of the brain and its relation to mental processes under extreme cold conditions concludes with the following (underlining is ours):

> "This conclusion is confirmed by results of psychometric investigations <u>if we take into consideration the link between the degree of introversion</u> and the magnitude of nervous system strength....
>
> All of the abovesaid confirms that theoretical studies of the dynamics of man's psychophysiological conditions should be determined <u>taking into account the general and specific type of higher nervous activity of the examinee</u>. An objective understanding

> of changes in the functional properties of the CNS in the course of adaptation (to cold) may be achieved only on the basis of combined psycho- and neurophysiological investigations by quantitative methods; this will help solve the problem of psychological selection of personnel."

Notice that "introversion" referred to in the quotation is the same as Variable B in Example 5.

The Russians evidently consider selection of personnel for cold-weather duty to be a very serious issue (the article is entitled "Urgent Tasks of Psychophysiological Studies in the Antarctic"). The quotation concerns selection of scientific personnel for Antarctica. One might assume there must be even more sophisticated material pertaining to military operations in the cold.

An analysis of the differences between Soviet and American cultures presents an apparent paradox with respect to the behavioral science research approaches of the two countries. On the one hand, the Soviet Union, with its communist orientation, appears to western eyes to be a country in which the sameness of people is commonplace. Individual initiative is encouraged, but is directed collectively toward support of the state. Emphasis is placed on group identity and a classless society. People tend to dress, eat and live alike. Nonconformity in thought and expression is discouraged or punished.

On the other hand, American values seem to derive from differences between people, such that both self-expression and individual initiative are encouraged. Freedom of thought and choice are fundamental. Government exists to serve the people; individual rights are paramount and transcend all else. Dress, food preferences and life styles vary widely.

It appears paradoxical, then, that the Soviet Union, although oriented around the collective, supports an individual differences approach to research, while the United States, which encourages individuality, fosters predominately normative research.

This constrast appears paradoxical only when viewed through American eyes. If one looks analytically beneath the apparent uniformity of Russian life, a deep concern for individuality can be found, tempered by the political constraints of the totalitarian system. By similar analysis, beneath the apparent diversity and individuality of Americans, one can find considerable conformity in behavior, in the context of political freedom.

The basis for the above may lie in differences between the two countries in child-rearing practices. According to Bronfenbrenner, (16) Russia has become a matriarchal society since World War II, as a result of the decimation of its male population in that war. As one effect of this change, children now receive much affection, emotional

support, and guidance from both male and female adults. Even when children are taken from their homes at early ages and reared collectively (and politically indoctrinated at the same time), they, nevertheless, receive constant attention as individuals, and warm, loving, personal care by adults in the collectives. While in school, they compete for academic awards in teams, but heavy emphasis is placed on individuals as contributors to team success. The notion of the integrity and worth of children as individuals pervades the society; they are highly valued, and are dealt with as though small, but real, adults.

An opposite picture emerges with regard to American society. Here, while children may be thought of as individuals, they are not treated that way. In our patriarchal society, children implicitly are expected to fend for themselves, and to develop their own individualities. Open expressions of warmth, affection, and emotion are not sanctioned, particularly among males. The children receive open emotional support primarily from the mother. However, as Bronfenbrenner points out, in the typical middle-class household, the father's work schedule, the mother's social and/or work demands and the children's own activities combine to limit opportunities for maternal expression of affection.

As a result, children have developed a reliance on peer groups rather than on parents for finding strong emotional support and self-identity. Although peer group cultures superficially may give the appearance of children performing and behaving as individuals, in reality, they conceal a pervasive similarity among children. Thus, in the context of great political freedom, many of our youth tend to wander aimlessly, seeking themselves.

We are all products of our culture; it shapes our thoughts and actions, and determines how we think and approach our problems. It is not paradoxical, then, to see differences emerge between the two countries in their approaches to research; emphasis on individuality in Russia has resulted in a behavioral science with a distinctly individual flavor, while American science has evolved with a normative orientation, dealing mainly in generalities.

It is our belief that we are nearing the limits of what a normative approach to science can yield for the Army. A great deal of descriptive information about human behavior had been amassed, but it has little practical value for the selection of soldiers for duty in extreme climates. Such selection is essential if the Army is to remain competitive with other world powers. It would be sad, indeed, if we had to relive Omaha Beach, but now in deep snow at -40°F, because of an unnecessary lack of adequate information about human performance capabilities.

We have attempted to clarify the differences between the normative and individual differences approaches to research and to

indicate the direction in which military research should go. The implementation of such research by a few investigators is not sufficient. What is needed is a realization at the highest staff levels that serious problems exist with military operations in extreme climates, particularly in the cold, and that these problems can be solved only by a major change in research orientation.

References

1. Levi, L. Sympatho-adrenomedullary responses to emotional stimuli: methodologic, physiologic and pathologic considerations. In E. Bajusz (Ed.) An introduction to clinical neuroendocrinology. New York: S. Karger, 1967.

2. Fine, B. J. and Kobrick, J. L. Effects of high altitude and heat on simulated artillery fire direction center tasks. Proceedings of Army Science Conference, U. S. Military Academy, West Point, N. Y., June, 1976.

3. Venables, P. H. Change in motor response with increase and decrease in task difficulty in formal industrial and psychiatric patient subjects. British Journal of Psychology, 45, 101-110, 1955.

4. Discipio, W. J. Divergent thinking: a complex function of interacting dimensions of extraversion-introversion and neuroticism-stability. British Journal of Psychology, 62, 545-550, 1971.

5. Krupski, A., Raskin, D. C. and Bakan, P. Physiological and personality correlates of commission errors in an auditory vigilance task. Psychophysiology, 8, 304-311, 1971.

6. Moses, J. L. Field dependence and the prediction of vigilance performance. Dissertation Abstracts, 28, 1719, 1967.

7. Bucklin, B. L. Field dependence and visual detection ability. U. S. Army, Picatinny Arsenal, Engineering Sciences Laboratory, Dover, N. J., Technical Report 4137, 1971.

8. Thornton, C. L., Barrett, G. V. and Davis, J. A. Field dependence and target detection. Human Factors, 10, 493-496, 1968.

9. Fine, B. J. and Kobrick, J. L. Note on the relationship between introversion-extraversion, field-dependence-independence and accuracy of visual target detection. Perceptual and Motor Skills, 42, 763-766, 1976.

10. Fine, B. J. Introversion-extraversion and motor vehicle driver behavior. In H. J. Eysenck (Ed.) Readings in Extraversion-Introversion, Volume 2, New York: Halstead, 1971.

11. Conklin, R. C., Muir, W. and Boersma, F. J. Field dependency-independency and eye movement patterns. Perceptual and Motor Skills, 26, 59-65, 1968.

12. Fine, B. J. Personality traits as related to symptomatology and running performance at altitude under normal and drug (acetazoleamide) conditions. Perceptual and Motor Skills, 27, 975-990, 1968.

13. Fine, B. J. Psychological Problems of Men in the Arctic. Psychological Program For AMRLA. Staff Report to Commander, USARIEM, Natick, Massachusetts, 5 December 1973.

14. Rioch, D. McK. Psychiatric problems of man in the Arctic. In F. R. Fisher (Ed.) Man living in the Arctic, Washington, D.C.: National Academy of Science-National Research Council, 1961.

15. Bundzen, P. V. Urgent tasks ofpsychophysiological studies in the Antarctic. In A. L. Matusov (Ed.) Medical research on Arctic and Antarctic expeditions. Russian translation published for National Science Foundation, Washington, D. C. by the Israel Program for Scientific Translation, Jerusalem, 1973.

16. Bronfenbrenner, U. Two worlds of childhood. New York: Russell Sage Foundation, 1970.

The views of the author do not purport to reflect the positions of the Department of the Army or the Department of Defense.

Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER M 15/78	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Human Performance Under Climatic Stress and the Fallacy of the "Average" Soldier: Potentially Serious Implications for Military Operations in Extreme Climates		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Bernard J. Fine and John L. Kobrick		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Research Institute of Environmental Medicine, Natick, Massachusetts 01760		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 3E161102BS08 Environ. Stress, Physical Fitness and Med.Factors in Mil.Performance.WU01184182011
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Medical Research & Development Command Washington, DC 20314		12. REPORT DATE 13 March 1978 13. NUMBER OF PAGES 15
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Same		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Distribution of this document is unlimited.

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

NA

18. SUPPLEMENTARY NOTES

NA

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Climatic Stress, Human Performance, Individual Differences, Research Methodology

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Investigators in the life sciences in this country generally rely on a normative approach in evaluating experimental results; group averages are compared statistically and conclusions are based on the probabilities of occurrence of the obtained results. The conclusions tend to be interpreted as applying to the "average" person, a concept deeply ingrained in military policies which assume that all soldiers can perform all tasks equally well under all conditions.

Normative research grossly misconceives the extent of differences among

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

soldiers in all aspects of functioning and leads to what may be called the fallacy of the "average" soldier. Research examples clearly illustrate the fallacy and its potential for exposing certain individuals to unwarranted life-threatening risks.

An alternative to normative research assumes and studies the systematic differences between people. Selecting special troops for arctic duty is discussed as one application of this type of approach.

A comparison of the orientation of American and Soviet research on human behavior in extreme cold suggests that cultural and other background factors can account for the Soviet emphasis on individual differences as contrasted with the American normative orientation. A change in research emphasis in this country from normative to individual is stresses as essential for military effectiveness in extreme environments.